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Using Second Life to enhance classroom management practice in teacher education

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The following article discusses an educational simulation created within Second Life (SL) in order to assist pre-service teachers (PSTs) in gaining more experience managing student behavior. The article discusses the development, implementation, and assessment of the simulation as well as student data on the feasibility of the approach in comparison to other methods of learning classroom management. It includes discussion of the use of artificial intelligence (AI) methods to infuse the simulation with random student behavior, much as it would arise in the classroom. Results indicated that the students found the simulation to be a useful learning experience and put them in situations that forced them to think on their feet. Recommendations for future work with the simulation and for others considering the use of SL for educational purposes are discussed.

Der Gebrauch von Second Life zur Verbesserung von Unterrichtsmanagement in der Lehrerbildung

Im folgenden Beitrag wird über eine im Second Life (SL) erstellte Ausbildungssimulation zur Unterstützung von auszubildenden Lehrern (PSTs) beim Erwerb von Kompetenzen beim Steuern von Schülerverhalten berichtet. Der Artikel beschreibt die Entwicklung, die Einführung und Bewertung der Simulation ebenso wie die Studentendaten bei der Umsetzung der Annäherung im Vergleich zu anderen Methoden des, lernenden Klassenzimmer "…Managements". Es schließt Diskussionen über die Nutzung von Methoden künstlicher Intelligenz (KI) zur Einführung der Simulation mit zufälligem Schülerverhalten in der Art, wie es im Unterricht entstehen könnte, ein. Die Ergebnisse zeigen, dass die Studenten die Simulation als nützliche Lernerfahrung ansahen und und die sie auch in Situationen benutzen, in denen sie zu grundsätzlichen Überlegungen aufgefordert waren. Empfehlungen für zukünftige Arbeit mit Simulationen und für andere Überlegungen des Gebrauchs von Second Life für pädagogische Zwecke werden angestellt.

L'utilisation de Second Life pour renforcer la pratique de la gestion de classe dans la formation des enseignants

L'article qui suit fait le bilan d'une simulation éducative crée au sein de Second Life (SL) dans le but d'aider les enseignants en formation (PSTs) à acquérir davantage d'expérience de la gestion des conduites d'élèves. Cet article examine le développement, la mise en place et l'évaluation de la simulation ainsi que les données provenant des étudiants sur la viabilité de ce mode d'approche par

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comparaison avec les autres méthodes d'étude de la gestion de classe. On y inclut une discussion sur l'usage des méthodes d'intelligence artificielle (IA) pour intégrer la stimulation avec le comportement aléatoire des élèves tel qu'il peut se produire en situation de classe. Les résultats ont indiqué que les enseignants en formation ont trouvé que la simulation était une expérience d'apprentissage utile et qu'elle les plaçait dans une situation qui les forçait à penser debout sur leurs pieds. On présente des recommandations en vue de travaux futurs avec la simulation et d'autres portant sur l'usage possible de Second Life à des fins éducatives.

El uso de Second Life para mejorar las prácticas de la gestión de aulas en la formación de los profesores

El artículo abajo trata de una simulación educativa creada dentro de Second Life (SL) para ayudar a los futuros profesores (PSTs) a adquirir más experiencia en el manejo de la conducta de los alumnos. El artículo examina el desarrollo, la puesta en práctica y la evaluación de la simulación además de los datos procedentes de los alumnos acerca de la factibilidad de este abordaje en comparación con otros métodos de estudio de la gestión de aulas. Se incluye también un estudio del uso de los métodos de (IA) inteligencia artificial para dotar la simulación de conductas estudiantiles aleatorias ,parecidas a lo que ocurre en aulas reales. Los resultados han mostrado que los futuros profesores opinan que la simulación fue una experiencia de aprendizaje útil, poniendoles en situaciones que les obligaban a pensar « de pie ». Se hace también recomendaciones para otros trabajos, unos con la simulación y otros sobre los usos posibles de Second Life con fines educativos.

Keywords: virtual learning; simulation; teacher education; artificial intelligence

Background

New teachers often list discipline as an area in which they still feel unprepared after graduation (Koetsier & Wubbels, 1995). The best situation for learning management skills is the real classroom; however, as demands on teacher time and accountability increase, it has become more difficult to find enough classrooms and supervising teachers. Finding classrooms where teacher candidates are free to try techniques learned at university may also be difficult (Putnam & Borko, 2000). Further, studies on culturally relevant classroom management reviewed by Gay (2006) clearly show inequities in regards to behavior management for students of color. Such situations, notes Resnick (1987), call for creativity by teacher educators such as designing special simulations or partnership arrangements. In order to help pre-service teacher (PSTs) better grasp how to work with students from a variety of cultural backgrounds, each was assigned an imaginary student developed by the professor with an in-depth academic and behavioral profile. Through collaboration, the PSTs then had to create an appropriate learning and management plan for a group of these imaginary students. Unfortunately, the plan lacked an element of authenticity regarding the most difficult aspect – behavioral interaction. Upon learning of the co-author Bryant's (Miikkulainen et al., 2006) work in gaming through artificial intelligence (AI), the question arose whether such technology could be adapted to enable students to simulate management scenarios.

The value of simulating classroom behavior

Increased capability and access to educational technology enables the use of real-time classroom simulations. Our project was based on principles of constructivism and

situated cognition. Notes Jonassen (1992), constructivism "is concerned with how we construct knowledge from our experiences, mental structures, and beliefs that are used to interpret objects and events" (p. 139). Thus, a central theoretical tenant was that learning experiences must be situated within authentic tasks. Educational technology could be a vehicle for authentic learning as long as the tasks closely replicate the real activity. Environments such as Second Life (SL) (Linden Research Inc, San Francisco CA, USA), a massive multi-player online game (MMPOGs), used in our project have been considered a type of microworld. "Microworlds are perhaps the ultimate example of active learning environments, because users can exercise so much control over the environment" (Jonassen, 2000, p. 157). This control allows the learner to construct understanding relative to the situation and his/her own existing knowledge and experiences. Jonassen, Howland, Moore, and Mara (2003), argue that such environments have enabled the building of mental models – an essential component of constructivism – because they require users to explore, assess, and manipulate the environment. He believed such platforms were ideal for education because they would allow for collaborative problem-based inquiry as well as adaption to student needs and cultures. Prensky (2001a) argued that game technology enables inquiry-based learning central to constructivism, and appeals to the ways a digitally raised generation, such as our teacher education students, thinks (2001b). In a comprehensive review of the literature, Herrington and Oliver (2000) concluded that technological educational simulations can "provide viable alternatives to the real life setting provided they do not sacrifice authentic context" (p. 297). In addition to authenticity, much simulation research (Gee, 2003; Jonassen, 1997; Reigeluth & Schwartz, 1989) has emphasized maintaining the integrity of the simulated learning experience. The situation must revolve around a specific task orientation that requires strategic thinking and action. This observation-based process has been known as "legitimate peripheral participation" (Lave & Wenger, 1991) in which the learner moves from observing the desired behavior and reflecting upon observations of it, to increasing responsibility of performing the behavior in a learning situation, and finally collaboration with others.

Jarmon, Traphagan, and Mayrath (2008) reviewed the literature on the use of 3D virtual worlds for teaching and learning. Citing a great deal of research (e.g., Craig, 2007; Dede, Clarke, Ketelut, Nelson, & Bowman, 2005), they found that such activities have the potential to increase student motivation, collaboration, discovery, social interaction, creativity, and address different learning styles.

Yet even with technological advances, little research has been found on the creation and applicability of such tools within teacher education. Cochran-Smith and Zeichner (2005), in an overview of simulation studies from the 1980s and '90s, contend that results were mixed. Two studies related to classroom management. Strang, Landrum and Lynch (1989), used a computer simulation to track student performance in classroom management while teaching spelling. Results from the 61 participants revealed increases in use of encouragement, feedback, and prompts. No change was made in their ability to involve students. Gorell and Downing (1989) completed an experimental study to determine if a computer simulation was best at helping students learn to analyze classroom behaviors for solving problems. While the results did show the simulation group used analysis skills more often, no improvement on knowledge or self-efficacy was found.

Girod and Girod (2005) reported on a simulation where teacher education students were assigned to teach six virtual K-12 students and then measured learning outcomes

in order to adjust their next lesson. The authors found that the simulation had a positive, significant affect on the treatment group's abilities to connect their teaching to learning outcomes. Ferry et al. (2005) showed the effect of a computer mediated communication tool for improving literacy instruction skills. The simulation enabled the students to be involved in scenarios requiring a series of increasingly complex teacher interventions. Results showed that learners effectively analyzed situations by slowing or accelerating learning situations, and by revisiting them. Students reported feeling better able to analyze situations in the field, and to attend to behavioral nuances.

Most like our project is an initiative known as SimSchool (Gibson, 2007). This is a comprehensive, online, AI-based tool that enables students to contextualize their learning around a range of skills including behavior management. The PSTs become faculty members in a K-12 low-income school, receive profiles of their diverse students, and then complete a series of assignments. Gibson (2004) explains, "The SimStudent 'learns' by storing temporary changes in variables that directly determine the three kinds of behaviors. The goal state for the game is to have the teacher-user succeed in getting all SimStudents to increase time in positive body positions, using positive conversational responses, and improving task performance" (p. 3). In order to enable this learning (Gibson, 2007), teachers choose from a menu of possible behaviors under the various tasks.

Research on the use of SimSchool has shown positive effects. Foley and McCallister (2005) reported significant small increases in disciplinary efficacy, and climate building. Qualitative results showed students found the simulation made them think through the array of teacher tasks such as creating a classroom management plan, and responding to student needs.

Comprehensive reports on SL projects and research can be found via the SL site and others such as Purdue University's Bibliography of Second Life Education (2009). Nonetheless, empirical research on the use of SL within teacher education seems extremely limited. While numerous articles exist about SL educational projects (Boulous, Hetherington, & Wheeler, 2007; Conklin, 2005; deWinter & Vie, 2008) few report on research studies. One exception is work by Gao, Noh, and Koehler (2008) who examined quantitative differences in turn-taking during role-playing activities between a face-to-face activity and a SL activity. No differences were revealed in the amount of communication; however, in SL, students took more turns, and had more concept-related discussions. On the other hand, they had shorter, less elaborated exchanges than in the face-to-face activities. Cheong, Yun, and Chollins (2009) utilized SL as a venue for teaching practice for 150 students who were required to teach a lesson to their peers. Self-reports by the participants showed they believed SL to be a viable method to help them practice their teaching skills outside of the standard classroom.

The management simulator

We licensed a "private island" in SL in order to avoid disruptions by mischievous game players using the SL server for other purposes. The island was large enough to construct a 3D model of four classrooms and other parts of a school's campus – a science laboratory, a lavatory, and administrative offices, all connected by hallways lined with student lockers. The grounds of the schoolyard are also modeled and accessible for use during simulations. The researchers created 30 middle school students for the simulation (Figures 1 and 2 (Second Life, Linden Research Inc, San Francisco, CA, USA).

Figure 1. A science lab within the virtual school (Second Life, Linden Research Inc, San Francisco, CA, USA).

Figure 2. A general classroom (Second Life, Linden Research Inc, San Francisco, CA, USA).

PSTs received individualized character profiles on each avatar to add detail to the simulation. The profiles included three years of academic history and standardized testing results. Sociocultural factors were also included such as family structure, parent occupation and educational level, socioeconomic status, health, race, ethnicity, language background, and religion. Finally, we included notes on the history of parent–teacher conferences and each student's overt physical and behavioral habits.

These middle school students are placed into the SL environment as articulated 3D models, with appropriate physical attributes. Their behavior in the simulation is controlled either by a PST participating in a simulation, or by software written to support the behavioral specifications. We refer to the simulated students using standard terminology for games and systems such as SL: an *avatar* is a simulated character directly controlled by a human participant, and a *bot* (short for "robot") is a simulated character controlled by software. Avatars and bots can be used together in a single simulation; for example, bots can be used to fill out a simulated classroom when there are not enough human participants to control the number of avatars that would be needed.

The software for controlling the bots was developed by university students working in an AI research laboratory. The software uses a third-party toolkit called libSL, which allows the bot controllers to operate from an otherwise standard login to the SL server. The developers also provided appropriate appearances and canned gestures for both avatars and bots. A single instance of the control program can control up to eight bots; further bots must be controlled by additional instances of the program running on different machines, because of limits on the necessary communication bandwidth.

The bot controllers are based on *finite state machines* (Rich, 2007), a theoretical and practical construct used by computer scientists, game programmers, and engineers. Such machines define a fixed number of abstract states, plus a set of rules that defines how the machine transitions from one state to another. For present purposes, our controllers are built around four states: initial state, sleep state, uncontrolled state, and controlled state, where "controlled" and "uncontrolled" refer to the bot's current state of behavior. Every bot begins in the initial state, but transitions into other states as the simulation progresses. For maximal control of the PST experience during our initial experiment, the controller uses deterministic state transitions that are triggered by a timer or by specific actions (or lack of action) by the simulated teacher.

In general, the student-bots transition to uncontrolled behavior according to a predefined schedule, and the teacher-avatar of a PST can cause the bots to return to a state of controlled behavior by means of appropriate intervention. Utter lack of attention by the teacher to a student that requires attention causes that student to transition into the sleep state after a pre-determined time. The bot controllers activate appropriate gestures and utterances whenever a bot changes state. This includes actions such as raising a hand to ask a question, getting out of seats, or putting the head down for a nap.

The bot controllers search the utterances of the teacher-avatar for keywords or phrases that indicate that the student is receiving the sort of intervention needed, for example calling the student's name when the student-bot's hand is raised. The combination of timer-based state machines and token-based language processing provides a very simple, but effective, control system for the bots. We are now

investigating the use more sophisticated methods for control and interaction from the field of AI for future iterations of the project.

Simulation procedures

Because of the increased pressure on teachers and students in regards to high-stakes testing at the K-12 level (Spring, 2009), the experiment was designed to simulate a testing situation. The PSTs participating in the experiment were seated together in a small computer lab. They had not previously seen the simulation, and thus were given half an hour to familiarize themselves with how to manipulate the avatars and use the communication tools. Since non-verbal communication is an important aspect of classroom management, it needed to be used extensively during the experiment, so the PSTs were given a typed list of keyboard shortcuts that gave ready access to different gestures in SL in order to encourage their frequent use.

In the interest of time, the project programmers placed the student avatars (SA) in the seats before the PSTs arrived. As previously noted, each SA was based on an imaginary student profile given to the PSTs earlier. These profiles listed the SAs typical classroom behaviors, such as "passes notes", "speaks without raising hand", or "gets out of seat without permission". Where appropriate the profiles also listed which imaginary students were friends, and which had previously gotten into fights or had disagreements. The SAs were seated in a classroom formation that would facilitate the talking or misbehavior that might occur between them as indicated by their profiles.

Two PSTs at a time role-played the avatar-teacher during the experiment. That position was rotated among the PSTs throughout the course of the simulation, so that as many as possible would have an opportunity to work from the perspective of the teacher. Because of a limitation of available equipment, these two PSTs were the only participants with the capability to use SL's voice chat feature. All other PSTs role-playing the SAs were required to type all of their responses to the teachers. The remaining PSTs shared a computer with a partner, running multiple SL clients on each machine. They were instructed to alternate between role-playing the SA, and observing the interactions of their partner's avatar with the simulated teacher. During the first half of the experiment, the partners were not allowed to speak in order to encourage independent decisions about the behavioral responses; during the second half, the partners were instead encouraged to collaborate in their misbehavior in order to increase the challenge for the PST role-playing the teacher.

Since the experiment focused on a testing situation, the following was written on the simulated classroom's blackboard at the beginning:

> Today is test day. You will have 30 minutes to complete this test. If you have any questions, please raise your hand and I will come to you. When you are finished with the test, please complete the questions in your textbook on page 256.

Obviously, a teacher's goal is to conduct an orderly test session where the students can focus on the questions, but the goal of the PSTs participating in the experiment was to simulate disruptive behaviors among the SAs. This forced the PSTs to think from both sides of the teaching/learning process. The PSTs controlling the avatars were instructed to behave according to the profile they had been given previously. For example, if their profile indicated they were friends with another student, they might

engage in talking or arguing with that student, or even walking around the room to enhance such interactions. Other profiles instructed PSTs to have their avatar forget materials, pass notes, or ask to use the hall pass. A PST controlling the simulated teacher must learn to react appropriately to disruptions of every type in order to bring the classroom back to an optimal learning environment appropriate for the learning activity at hand, for example the simulated test used for the experiment. The 3D nature of the simulation allows a great range of behaviors and responses. For example, if a student greatly disrupts a lesson, the PST controlling the simulated teacher may find it appropriate to ask that student to leave the classroom and go the principal's office. Conversely, a student may make the common request to visit the nurse. The existence of such ancillary locations and elements within the simulation means that the PSTs can train on the total educational experience, which extends beyond the walls of the classroom proper.

A primary goal of the classroom simulator is to give PSTs broader familiarity with motivation and the ranges of potential student responses and counter-responses. Thus, the SA disrupts the teacher's intended plan for the test situation in some way such as talking, moving, refusal to participate, and so on. The teacher's chosen response might serve to extinguish the inappropriate behavior; however, it might also exacerbate and escalate the SAs response.

In order to ensure thorough participation, the PSTs were instructed to engage their SA in confrontation with the teacher no more than three times during the experiment. For example, if the SA was talking out of turn and was then corrected, the PST had the option of discontinuing the SAs talking immediately, or of defending/continuing the behavior, which would then likely elicit another response from the teacher. The PST could engage the SA two more times, but then was expected to acquiesce to the teacher's demands for the benefit of the other participants. Finally, in addition to responding to the PST controlled SAs, the teacher was also required to manage the random behavior of the bots as programmed into the simulation. As previously mentioned, the teacher would have to respond to a bot's behavior, or it would go into a sleep state. This, of course, also necessitated that the teacher continually monitored the bot, as sleeping would be considered an inappropriate test behavior.

Methodology

The current project grew from a simple question. Can a computer-simulated classroom provide an authentic environment for the learning of strategic decision-making in regard to classroom management for teacher candidates? Our study used a mixed method to answer this question. The sample for the study included 20 undergraduate PSTs enrolled in a 400-level teacher education course. There were seven males and 13 females. All of the students had prior coursework in educational psychology that addressed student behaviors, and the majority of students also had at least one practicum experience observing teacher/student behavior in a middle school classroom. Data sources included instructor/facilitator notes and observations as well as a questionnaire designed to capture student assessment of the simulation. The questionnaire included both open-ended items as well as Likert rating scales. For example, questions included:

- On a scale of 1–5, how would you rate the simulation for helping you think about classroom management issues?

- What was your impression of the simulation overall?
- What did you learn, if anything, from observing the behavior of the teacher?
- What was your experience like from role-playing the teacher? The student?
- How would you compare this simulation to other forms of learning about classroom management such as lecture or case study?

Analysis and results

Sixteen of the 20 PSTs returned their questionnaires. The majority of data was analyzed using constant comparative thematic coding appropriate to the qualitative method (Miles & Huberman, 1994). In addition, mean responses were calculated for the Likert items in which students were asked to rate the overall usefulness of the simulation in relation to certain criteria (1=poor; 5=excellent). In regards to rating the simulation for helping think about classroom management, the mean response was 3.4 (n=16). Lower ratings were given to the additional items. In rating the simulation for helping students respond to classroom management issues, the mean was 2.9 (n=15), whereas the lowest rating mean 2.7 (n=16) was given for the simulation's ability to help students envision a culturally relevant classroom.

PSTs overall reactions to the simulation indicated generally positive comments. The majority found it to be a creative and intriguing approach to studying classroom management. For example, one PST responded, "I thought it was interesting and a great way to practice teaching strategies in a controlled setting." Other PSTs saw it as a way to introduce classroom management calling it "eye-opening." Another stated, "It gave me an idea of how to control a classroom and how an entire class can be affected by not knowing what strategies to use."

There were generally two themes relating to negative comments and recommendations for improvements. Either PSTs had problems with the structure of the simulation experience, or they took issue with the technology. For example, they commented that there needed to be more structure to the running of the simulation itself and more practice with the system prior to playing. Others disliked the fact that only the teacher could use the voice chat, while one commented, "The system seems too clunky to be able to react the way I would in real life." They recommended having more individual time with the simulation, conducting it in a larger lab, and staggering the start time of class. Numerous PSTs commented that the avatars needed more scripted behavior, and to lessen the amount of misbehavior by any one student, but also broadening it to include more cultural differences. For instance, one said, "Have only a few students misbehave at a time. Have them do more multicultural things."

Although some PSTs found the simulation too chaotic to enhance their learning, the majority of students did report that they learned something about classroom management techniques from the experience. These comments generally fell under the themes of observations of inappropriate management techniques and ideas for improving techniques.

The PSTs noticed when the person role-playing the teacher engaged in inappropriate behaviors to manage the classroom. For example, one commented, "Just repeating commands doesn't work. Students quickly learn teacher won't discipline." Other PSTs recognized the value of patience, "Yelling gets a teacher nowhere. Must reason w/student."

In addition to observing the management behaviors used, PSTs also offered alternatives that the teacher could have used. Some of these suggestions included

thinking of the range of options open to the teacher such as the use of the teacher's physical space, for example, pulling a student aside or outside to talk. Another PST said, "Proximity! Walk up to students!" Others made a note of the difference in addressing the whole class versus the instigator, and one PST commented that when the SAs were behaving appropriately they should be rewarded.

Discussion and suggestions for future use

Overall, the results of this study suggest that using SL for a simulation of classroom management is promising. While we are hopeful about the use of the simulation in the future, we also recognize that using SL presents numerous challenges that must be overcome if the learning experience is to be optimal. The two most important factors are structure and technology. For example, the computers we used were designed specifically for advanced gaming, and still they crashed numerous times during the simulation because of server strain. This caused some students to have to stop and watch others at terminals, greatly reducing the potential for learning from the initial simulation. Secondly, the way in-game objects are created, by texturing, shaping, attaching, and scripting prims, or primitives, created slowdowns. Any segment of the world could only handle a limited number of prims, and even without reaching this limit, having enough prims in one small area would cause noticeable slow down in the simulation. As the SAs started inhabiting the world, their appearance became a problem. As a large number of avatars, and thus prims, had to exist in a small space, we were forced to limit their appearance. This led to some unnatural and similar-looking avatars, which was not ideal for a realistic artificial classroom. Even with attempted prim limitation, there were still problems with slowdown in actual testing of the simulation. We had attempted to have all PSTs in one computer lab. Because SL is run on external servers, every human player had to connect to the outside world through SL, and the connections tend to be slightly bandwidth intensive. We found that after connecting some number of avatars to the server in one lab, we would get to a point where avatars would begin auto logging off, which only occurred when we attempted to run at full capacity within the class.

We also did not consider what we call the "play factor." Although PSTs were given specific instructions as to the number of times they were to disrupt the learning environment, they blatantly disregarded this rule. One even commented, "It was fun to misbehave for a change." Thus, some PSTs were badgering the teacher, limiting options for involvement for others. This behavior tended to overshadow the benefits that could have come from the inclusion of the bots in the simulation. We also learned that if each object in the room was not locked for manipulation by the island administrators, PSTs would rearrange the learning environment. Despite our naïve expectations, students did not stick to a range of behaviors typical of a classroom, for example they had to be instructed that flying was not possible in the regular classroom!

We also encountered implementation complications with the AI. When logged into the world directly using SL, human controlled avatars will automatically load a default body and set of clothes. Bots must be programmed to do this, which required the use of temperamental libraries that would occasionally result in buggy behavior, a problem that required force logging them out before logging them back in. Problems like these forced us to build the bots in a number of distinct stages. The next stage of progress involved scaling up the number of bots that could be run by one call of the

program. Although no hard limit was found, large numbers running off a single machine were prone to communication errors, and eight bots was chosen as the reasonable soft limiting factor.

In the future, we intend to rely more on the AI controlled avatars, and to reduce the range of role-playing behaviors of the PSTs. Revamping the AI so that it acts more like the probabilistic state machine initially envisioned would allow students to experience some form of artificial classroom environment without having to experience the scenario over and over again. Using distributed control of AI may end up being a preferred method of action, as it would allow for more unpredictability of student behavior, although in its current state the AI would not benefit from a distributed setup. Expanding the available animations for the students would also allow for the creation of a more realistic simulation, especially if in-game objects could be made more interactive. Despite some promise though, there are still some problems with the use of SL that may not be tractable. The necessity to have a full classrooms worth of distinct avatars for any single simulation means that at any one time only one teacher can ever use the simulation, and even this would likely require the use of multiple computers for an all AI run classroom.

Recommendations for others

We believe SL is a worthwhile venue for virtual learning in teacher education. Nonetheless, others considering its use may want to weigh the following factors including cost, time, and the aforementioned technology issues. The cost of purchasing a private island even on the non-profit scale available via Linden Labs is high. There is an initial set up fee (US$2400 for the first year) as well as maintenance charges (US$1600 annually thereafter). Thus the project is continually contingent on available sources of funding, or on transitioning to other virtual worlds being created to compete with SL (Young, 2010). The time involved to script the environment, create avatars and alter their appearance, as well as to outfit the school was very high. Most time consuming was the creation of appropriate gestures that required the use of animation software such as Blender. While free existing animations and objects are available in-world, it is also time intensive to go out and search for them.

We anticipate the potential for learning and collaboration through an AI-infused simulation could produce better situation-specific learning than computer-based technology where an AI interface is not present. The simulation enables a variety of engagement levels for the instructor and student. The instructor might act as the teacher avatar for whole-class demonstration. Conversely, a group-to group exercise can be created in which four users might control five virtual students each using a game-like interface (mouse, keyboard) for a total of 20 students in the classroom. These users try to disrupt the classroom by commanding their virtual students to perform pre-programmed basic behaviors while the other group controlling the teachers comes up with classroom management strategies.

Eventually, we hope that the simulation can provide a partial measure of candidate's management competence, and data for any necessary remediation. We have begun another simulation that is set to measure student self-efficacy in a pre–post test design with the assumption that the simulation will improve student's confidence in their management abilities better than other typical management instruction such as lecture or case study. In the future, we also hope to include more aspects of the learning environment, such as creating parent avatars, paraprofessionals, and

administrators, and to include a variety of teaching settings such as laboratories, small group instruction, and outdoor education. Finally, we would like to collaborate with international institutions, to broaden the PSTs awareness of different pedagogical approaches for culturally relevant classroom management

Conclusion

Classroom management is a key component to effective teaching and learning. Yet for various reasons, PSTs often do not have adequate experiences controlling student behaviors across a variety of settings. We believe that our project fills a gap in teacher education. It provides a way for students to have a highly personalized learning experience that enables them to improve their understanding and confidence related to classroom management so that ideally someday they may translate this experience into their classroom practice.

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